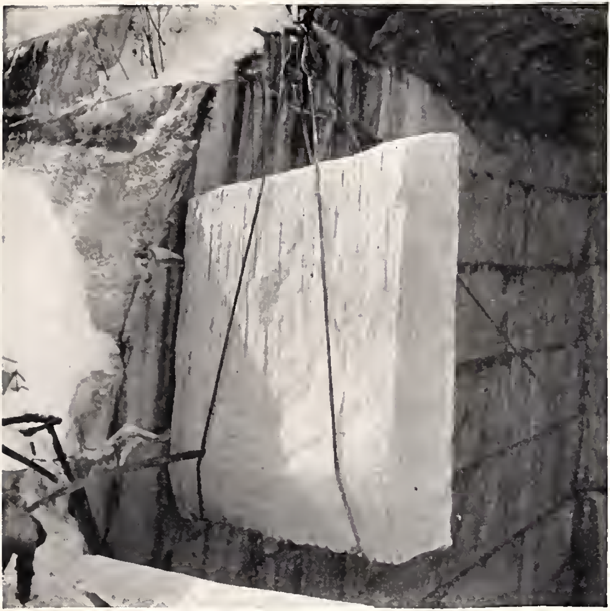
LITTLE PICTURES OF A BIG INDUSTRY



Raising from a Vermont quarry the sixty-three ton marble
block for the bowl of the Scott Memorial Fountain,
Belle Isle Park, Detroit, Michigan

Vermont Marble Company
PROCTOR, VERMONT

The Home of the Vermont Marble Company
Proctor, Vermont

The Purpose of this Booklet

IS TO EXPLAIN, VERY BRIEFLY, THE PROCESSES OF MARBLE WORKING, AS THEY HAVE BEEN APPLIED TO ONE OF THE OLDEST OF AMERICAN INDUSTRIES

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LITTLE PICTURES OF A BIG INDUSTRY

The Story of Vermont Marble

Geologists claim that at one time the whole Green Mountain area from the lower St. Lawrence to the present site of New York City was all under water. Then it was that the shell fish and lime-producing animals began the work of building marble beds. Ages afterward, when the layers of stone were well covered with clay and mud, there came a wrinkling of the earth's crust, which displaced the water with mountains and valleys and gave to the Atlantic a new shore line. Thus was Vermont marble formed and buried in the earth. For centuries it lay undisturbed.

Development of the Industry

The rest of the story has been often repeated. How, before the outbreak of the Revolutionary War, some one split the first slab of American marble from the ledges of Vermont; how it was turned into a fireplace hearth, and how others

On one of the lower floors of the Pittsford Valley marble quarry, 313 feet below the surface

Tunneling for a new floor in one of the underground quarries

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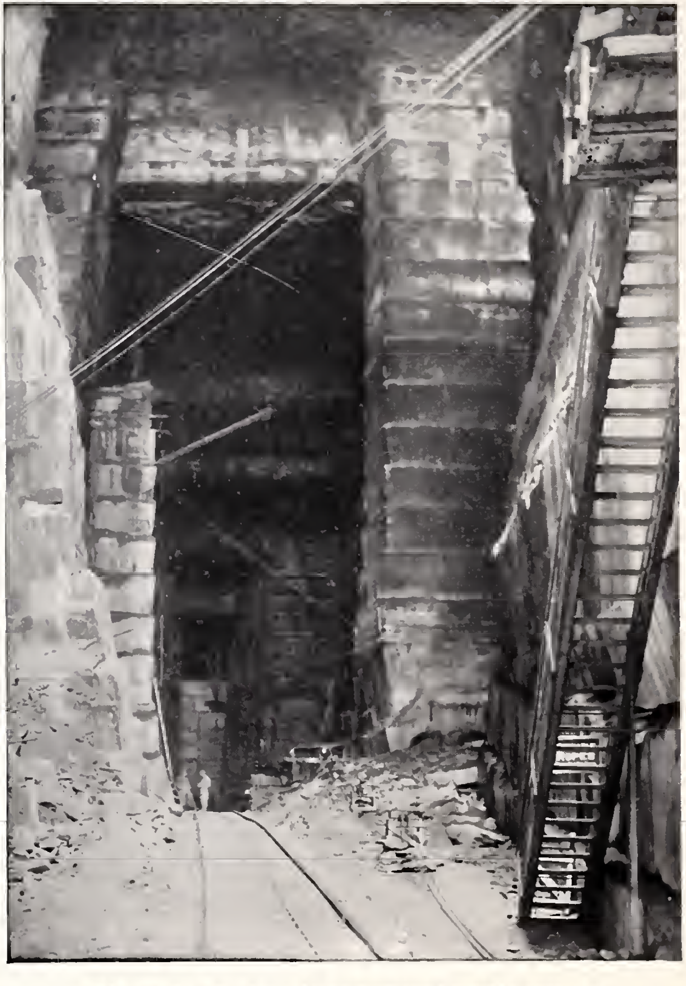
heard about the new material and carried away in ox-carts the attractive, heat-resisting fireplace stone. How, shortly afterward, some one cut the first Vermont marble tablet and paved the way for a thriving local business. How the trade was handicapped through a lack of suitable machinery and transportation agencies. How the railways came, and how, in 1870, there entered the field a man who took a slipshod mill and a half-developed quarry and organized the Vermont Marble Company.

Let us go back now to the unopened quarry, before the ground has been broken, and trace the methods whereby the marble is being raised from the Vermont mountains and made ready for the market.



The road to the tunnels, underground marble quarries, West Rutland, Vt.

Quarry Channeling Machine cutting out marble blocks from floor of quarry

The Channeler averages about 300 strokes a minute, and moves ahead two-thirds of an inch at every stroke

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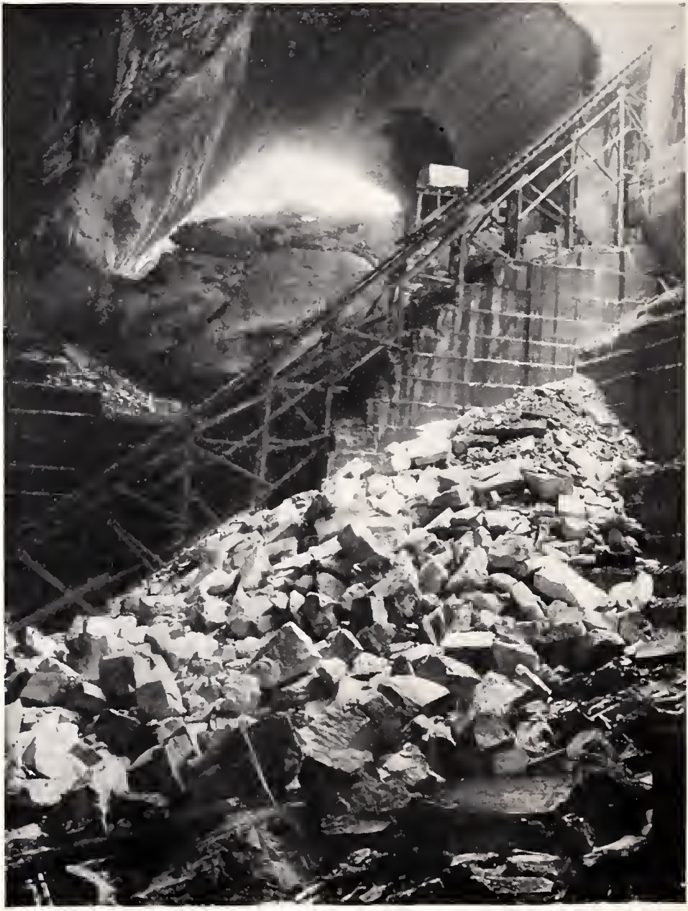
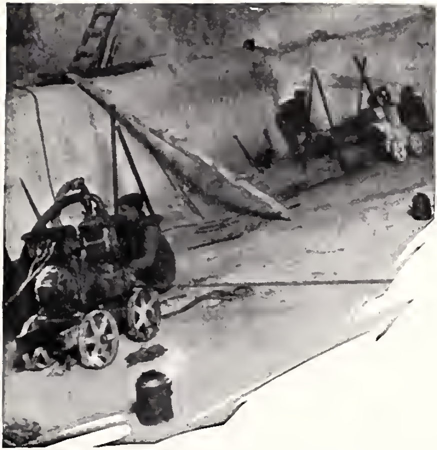
The Testing Machine

The seasoned quarry hunter, when he finds a spot where the signs are promising, will first call for the coring machine, with its revolving drill, pointed with diamonds, which may be sunk to practically any depth. By means of it, a cylinder of stone two or three inches in diameter may be taken out—a cylinder that shows the structure and quality of the marble through which the drill has passed.

When the coring machine has disclosed conditions warranting further development, a varying amount of waste must usually be removed before sound marble can be reached. The cost of this work frequently amounts to $50,000.



Section of inclined cable road over which blocks are raised from the underground marble quarries at West Rutland



Electric Drill, or "Gadder," boring holes in the channel courses for the wedging apart of the marble blocks

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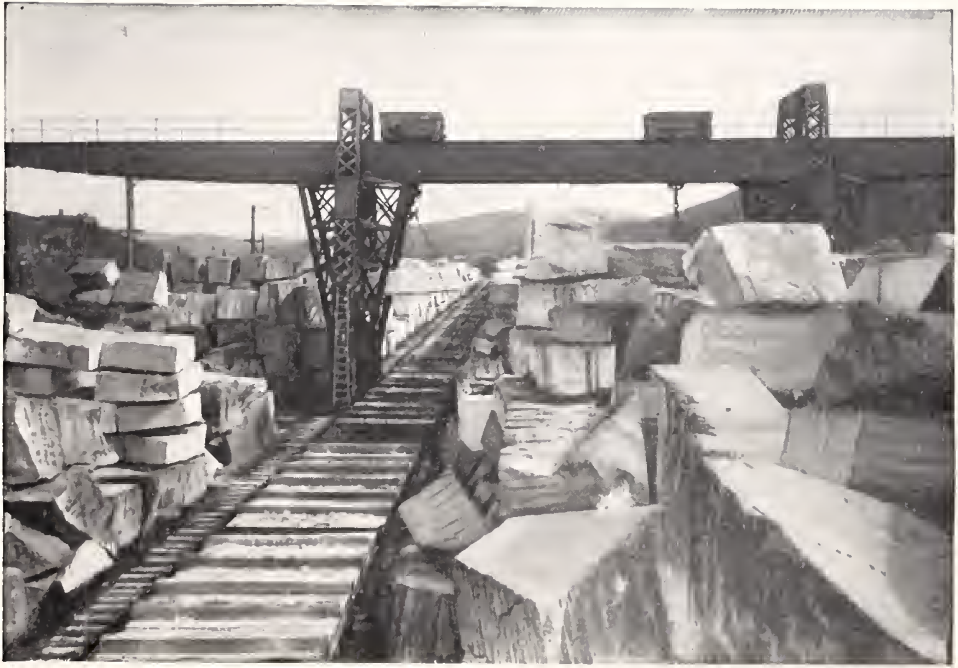
The Channelers

After more or less dirt and rock have been dislodged and carted away—a process which usually calls for careful and systematic blasting—the marble floor is ready for the channeling machines. The channeler runs on a movable track, and as it moves over the surface of stone, it cuts a groove about an inch in width. When it approaches the end of the track it is automatically reversed and sent back again. Thus it goes on eating its way downward until the groove has been lowered to a depth of several feet. The cutting is done by five chisel-pointed drills, clamped together in a row and attached to the end of a long bar. The resistless up-and-down motion of the bar forces the row of drills into the heart of the marble bed.



Corner of storage yard, West Rutland, where about 12,000 marble blocks are piled

Wedging along the lines of drill holes to divide the courses into blocks

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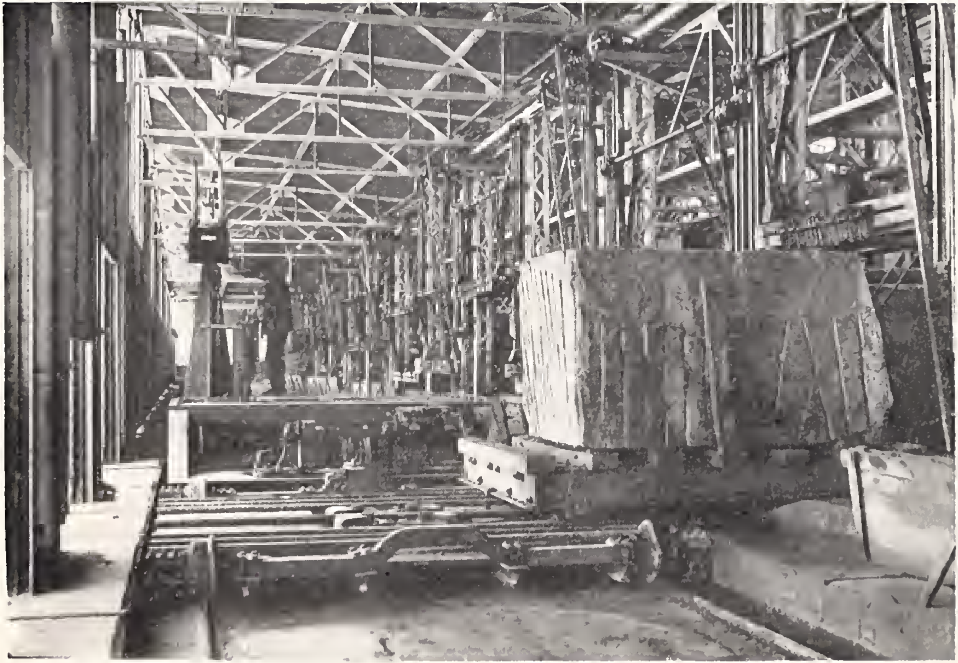
Drilling and Wedging

As soon as the floor of the quarry has been lined with parallel grooves of the required depth, the channelers are run across three adjacent cuts at right angles, dividing the two strips of marble up into cubes. The quarry blocks thus formed, which are known as "key" blocks, are broken off at the bottom by drilling and wedging. After the key courses have been cleared away, the remaining blocks in the floor are split out, at both the sides and the base, by the same process of drilling and wedging.

Taking Out Blocks

There are several ways of getting blocks out of the quarries. At Danby Mountain, the marble is brought down over a mile of cable



Interior of Mill No. 19 showing steel framework and electric transfer track for loading and unloading marble

Block of quarried marble in mill ready for sawing

© *Underwood & Underwood*

track, a drop of about 900 feet. At the West Rutland quarries, a part of the blocks are raised in the ordinary way by derricks; others are drawn up over an inclined cable track. This track is 500 feet long, and rises at an angle of 45 degrees. On the floor of the quarry, 300 feet below the surface, it connects with under-ground electric roads which extend for 800 feet out into the tunnel.

The Marble Mills

Once the marble is out of the quarry and loaded on cars, it is ready to go to the mills. The modern marble mill is constructed of steel. A track, over which the stone is brought in, runs from end to end of the structure. The adjoining space is divided up into stalls or compartments,

Middlebury Plant

Florence Plant

Center Rutland Plant

True Blue Mill

On these two pages are illustrated some of the plants which are manned and operated by the Vermont Marble Company. Many others might be included. These combined shops and mills are fed by the output from seventy-five quarries; they send out approximately 1,000,000 cubic feet of marble every year. They are equipped with the best of modern machinery and linked together by railways and power lines. These pictures with the figures that follow tell their own story of the expansion and development of the marble industry.

Alaska Quarries

Swanton Works

Manchester Works

Albertson Works

Floor space of shops and mills, 27 acres

Grades and varieties of marble produced, 50

Deepest quarry, over 300 feet

Channeling machines, over 100

Gang saws, 325

Rubbing beds, 112

Polishing machines, 100

Turning lathes, Carborundum machines and Planers, 60

Pneumatic tools, 450

Hydro-electric power generated, 13,000 H. P.

Annual output of quarry blocks, 21,000

Weight of average quarry block, 15 tons

Largest block ever quarried, 63 tons

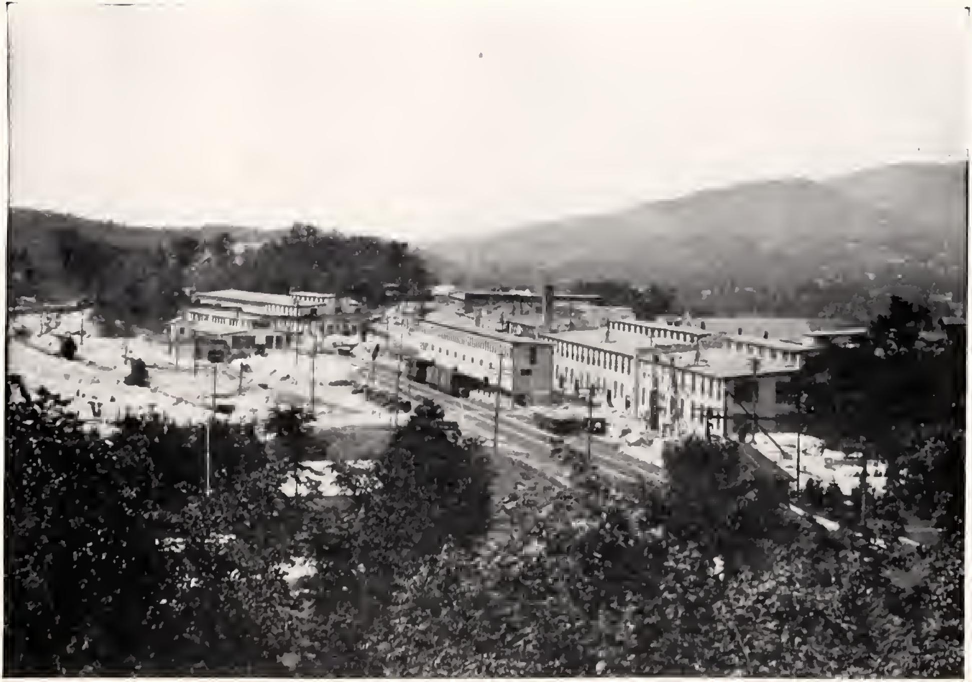
Land owned by the Company in connection with its marble business, 27,000 acres

West Rutland Plant

Danby Quarries

Roxbury Quarries

Dorset Quarries



Main Plant of the Vermont Marble Company at Proctor, the largest group of shops and mills in the industry

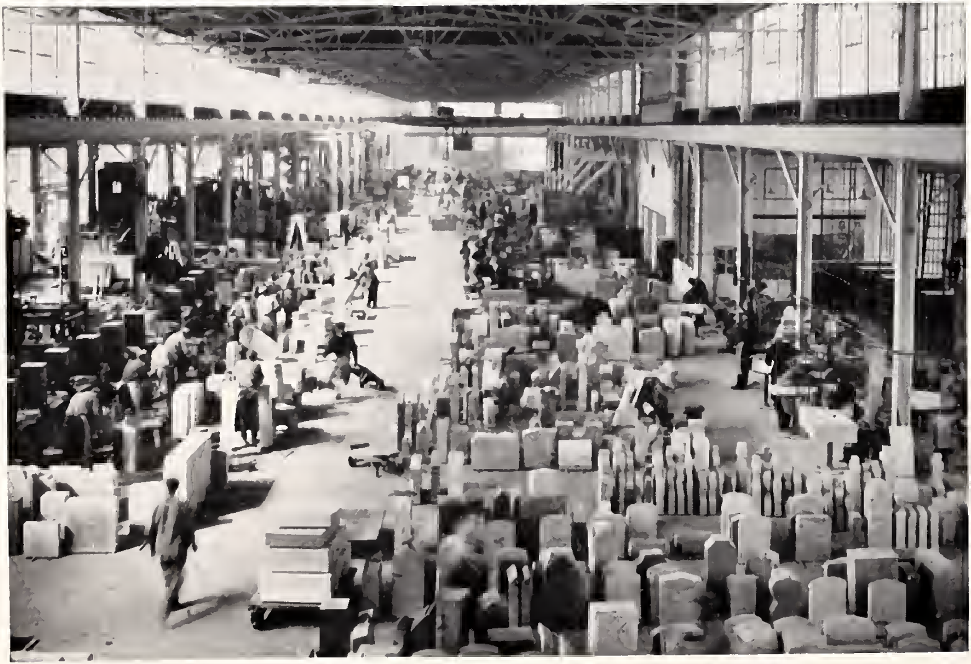
Looking down sand tramway, where it passes over Falls and Power House at Proctor, Vt.

© *Underwood & Underwood*

any one of which will accommodate a large quarry block. The sawing is done by smooth iron bands, set in a moving horizontal frame, and acting in conjunction with sand and water. While the soft strips of iron are being dragged to and fro across the marble, the water is pouring down over the top of the block, bringing the particles of sand which are to serve as teeth for the saws.

Providing the Sand

In the days of the old mill, a few teams could haul all the sand that was needed. When the business began to increase, a short tramway was constructed, but the buckets soon began to come



New Monumental Shop at Proctor
Largest building of its kind in the world

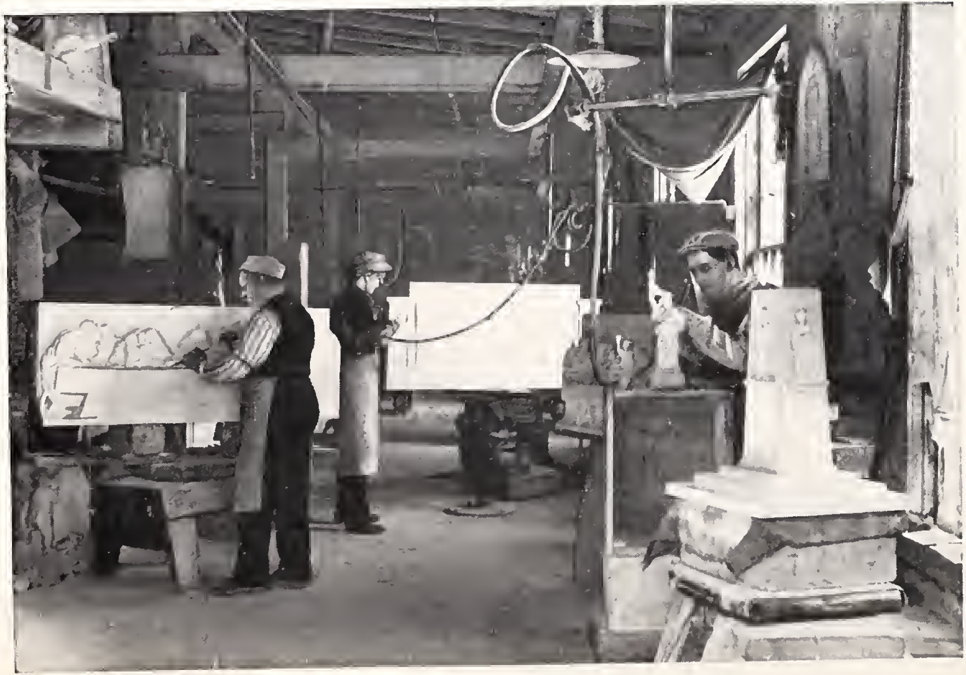
The Diamond saw has 125 diamonds in its rim and makes 600 revolutions a minute

© *Underwood & Underwood*

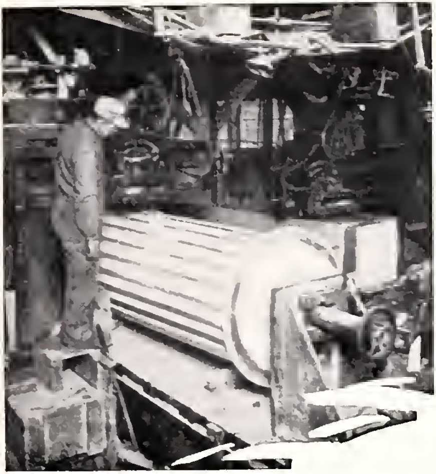
back empty. Finally, the cable was extended for two-and-a-quarter miles over the mountain to a larger deposit. It now brings in sand at the rate of 500 pounds every 28 seconds.

Monumental and Building

On leaving the mills, some of the marble goes directly to the monumental shops, some to the building department. If it comes out in the form of thin slabs, probably it will be used for interior building work. Within the shops it may find its way into one of the large lathes—for marble, like iron and steel, can be accurately turned—or it may be taken to one of the planing or molding machines.



Unusual types of carved work in Vermont marble



Cutting a fluted marble column in the planing machine

© *Underwood & Underwood*

The Diamond Saw

If it happens to be too large, it can be placed under the diamond disk saw. The rim of this saw contains approximately 125 diamonds and will cut the hardest of marble, provided it is well supplied with water.

The Rubbing Beds

By far the larger part of the marble that comes to the shops is delivered at the rubbing beds. There it is held in a fixed position on the surface of large revolving iron disks. The sand and water, which is spread over these disks, will take away the roughness and irregularity from the marble faces and give the cutter and polisher a chance to start.

Saint Gaudens Memorial, Cornish, N. H. (Augustus Saint Gaudens, the sculptor)

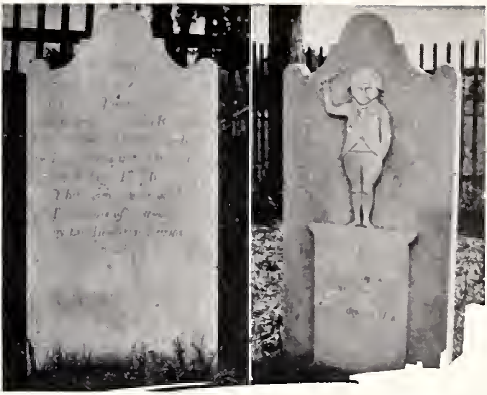
Pneumatic Tools

The marble cutter of today can do almost anything with pneumatic tools. He still uses the hammer and mallet now and then—there are times when they are safer and more satisfactory. But ordinarily, the modern workman, even the carver who executes the finest of sculptured work, turns to the chisel that is driven by compressed air.

Marble is available in a variety of finishes and the choice depends largely on the individual taste of the buyer. In these days much of the monumental and exterior building work is finished entirely with pneumatic tools. This often takes the place of sand, hone or polish. Marble for the interior of the building is usually given a high polish.

Large flat surfaces can be polished by machinery; curved and molded faces have to be rubbed down by hand. The polishing machine is a small whirling plate attached to a movable arm. These plates are of several kinds. Like the saws and the rubbing beds, they must be given plenty of water, but they use no sand. The one first employed is coated with carborundum; the second has a face of aloxite; the third is made up of fine hone. This hone finish, which is a sort of dull gloss, is one that is often specified, especially in monumental work. The last plate to be substituted is covered with felt and is used in connection with polishing putty. In the case of

Public Library, Detriot, Mich. Cass Gilbert, architect. Walls and entourage of Vermont marble



A Soldiers Memorial of Revolutionary days. Erected in 1776 at Clarendon, Vt. The photograph shows the two faces of the tablet as they look today.

hand polishing, the process is much the same, although, of course, more time is required for the completion of the work.

An Era of Expansion

Every one knows how the industry has expanded within the last fifty years. It is no longer necessary to go to New England church yards to see Vermont marble. The product has a country-wide distribution in these days; it has even entrenched itself in many of the foreign lands.

The extent of this advance can be pictured in no better way than by comparing one of the old tablets of the pioneers with a notable memorial of the present.

A Tablet of 1776

Look first at a Vermont marble slab which is typical of Revolutionary days. It was stilted, often ludicrous in design; it was finished entirely by hand; the inscription was poorly spaced and badly worded. No attempt was made to keep the stone clean or to protect it from weeds and undergrowth. Yet nothing could deaden the attractiveness of the marble or take away the simple life story which was stamped on its weather-defying face.

Arlington Memorial, National Cemetery, Arlington, Va.
Carrere & Hastings, Architects. World's largest cemetery monument

As an example of the other type, take the Arlington Memorial—the largest cemetery monument in the world—which was built within sight of the nation's capitol at a cost of nearly a million dollars. It is needless to refer to the plan or purpose of the structure. Much has already been said and written about this great Vermont marble tribute to our soldiers and sailors, with the Tomb of the Unknown Soldier at its entrance. But how many ever stop to trace the wide gap between the Arlington and the memorial work of the early church yards?

Comparisons

The one was planned and reared in the midst of struggle and privation and hardship, the work of hands trained to the axe and the plough. The other is a masterpiece of designing, produced largely by modern machinery amid surroundings conducive to faultless workmanship.

And yet, notwithstanding the great differences, each has a vital bearing on the story. Both are essential elements in the rise of the Vermont marble industry.

PHYSICAL PROPERTIES OF VERMONT MARBLE

CHEMICAL COMPOSITION

A chemical analysis of marble from our quarries in Vermont gives the following results:

Silicate of Alumina	0.22
Calcium Carbonate	99.15
Magnesia	.57
Organic Matter	.05
	99.99

CRUSHING STRENGTH

The marbles that we recommend for exterior work could be used in the base of a tower over three miles high before failure from compression would result.

ABSORPTION

Other tests made by the United States Bureau of Standards using a typical monumental variety prove that 100 pounds of Vermont marble will absorb only 0.103 pounds of water.

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